REMARKS

Applicants have amended the specification to correct the numbering errors. Applicants have amended the claims to better define the invention. Applicants respectfully traverse the rejection of the claims over the cited art and respectfully requests reconsideration.

Claim 1 as amended requires a bearing surface between the cone and the bearing pin, the bearing surface being formed of a steel alloy and having a diamond-like coating formed thereon. Nishiyama discloses a diamond-like coating formed on a tungsten carbide surface. The rings 6, 6B, 7A, 7B, 8A and 8B are formed of tungsten carbide as set forth at column 1, line 61, column 4, lines 65-66 and other places. Nishiyama does not anticipate the requirement of the DLC coating being formed on a steel alloy bearing surface.

Applicants submit that this difference is significant. Tungsten carbide materials are very hard and rigid. In the context of an earth boring bit, the jarring loads encountered by the bit during drilling may cause the carbide rings to crack. Furthermore, carbide components are more expensive than alloy steel. In column 1, lines 18-21, Nishiyama discusses the use of prior art alloys for drill bit thrust bearings, mentioning beryllium-copper and a hard-metal alloy. Nishiyama states in column 1, lines 21-30 that these alloys exhibit a short overall service life. Nishiyama teaches away from applying diamond coatings to hard-metal alloys and teaches instead to use a carbide ring such as tungsten carbide, titanium carbide or tantalum carbide, with a diamond film thereon.

The requirement that the bearing surface be formed of a steel alloy is contained in all of the claims as amended. Claim 11, as amended, sets forth another feature. It requires a single thrust washer, having one side in contact with a thrust shoulder formed on the bearing pin and another side in contact with a thrust surface formed in the cone. Claim 11 also requires a single sleeve having one side in contact with a bearing pin and another side in contact with a cone. This sleeve is exemplified by the numeral 41 and the thrust washers by the numerals 39 and 41 in Figure 1. Nishiyama does not show a single thrust washer, rather teaches two separate thrust washers 7A and 7B that engage each other in rotating sliding contact. Thrust washer 7A has one-side in contact with the bearing pin and another side in contact with thrust washer 7B. Similarly, thrust washer 7B has one side in contact with the cone and another side in contact with washer 7A. Hence, applicants thus submit that Nishiyama does not meet the requirements of

claim 11. Claim 14 similarly requires a single thrust washer with opposite sides in engagement with the thrust shoulders of the bearing pin and the cone. This is not suggested in Nishiyama. Claim 14 requires that the thrust washer be formed of a steel alloy, which is not suggested in Nishiyama.

Similarly, claim 21 requires a single sleeve with an inner diameter side in contact with a bearing pin and an outer diameter side in contact with a cavity surface in the cone. The claim requires that the sleeve be formed of a steel alloy having a diamond-like coating formed thereon.

Applicants further submit that Scott in view of Liston do not suggest claims 1, 12 and 13. Scott discloses forming a film 52 (Figure 5) of diamond on a carbide substrate, then removing the diamond film from the carbide substrate and brazing or soldering it onto a surface of a steel alloy bearing pin. In Figure 6, diamond layer 52 is attached to bearing shaft 30 or cutter 34 by brazing or soldering. Scott does not suggest DLC coating on a steel alloy.

Liston discloses coating surfaces of a bearing, particularly a roller or ball bearing, with hard coatings. As disclosed in Figures 4 and 5, the coatings are at least two different types and alternate with one another. Each coating is a polycrystalline composite material (column 9, lines 31-37). The coatings are applied by sequential vapor deposition techniques (column 9, lines 63-65). The materials of the polycrystalline layers may vary as set forth in column 10, lines 34-38, and may comprise ceramics, metals, alloys, nitrides, borides, carbides and oxides of transition metals, and other metals and alloys, carbon, such as diamond and combinations thereof such as carbon nitride and oxy-nitride. The preferred embodiment in Figures 4 and 5 employs titanium nitride for first polycrystalline layer 76 and niobium nitride for second material layer 78. There is no mention in the specification of using a DLC coating for polycrystalline layers 76, 78. The patent states at column 3, lines 67 – column 4, line 17 that the prior attempts employing diamond-like coatings have not been satisfactory. Combining Scott and Liston would suggest replacing the free standing diamond layer of Scott with polycrystalline layers of nitride materials. The combination would not suggest DLC coatings.

Referring to claims 8 and 20, applicants submit that claims 8 and 20 are obvious over Nishiyama and Lemelson. First, as mentioned above, both of these claims require that the bearing surface be of a steel alloy. As mentioned, Nishiyama teaches coating carbide bearing surfaces. Liston teaches a lip of a drinking glass or cup in a diamond-like coating. The coating is applied to glass, not to a steel alloy. Applicants submit that it would not be to one of average

skill to combine Lemelson with Nishiyama. Nishiyama deals with an earth-boring drill bit bearing, not a drinking glass. Applicants submit that the art concerning manufacturing drinking glasses is not analogous and would not be considered by one of average skill in the art of making earth boring drill bits.

Applicants submit that claim 17 is not obvious over Nishiyama in view of Garner and Liston. Claim 17 requires that the thrust shoulder of the bearing pin be formed of a steel alloy and have a DLC coating on it. Garner teaches diamond not DLC. Nishiyama teaches to form the diamond layers on carbide substrates. The layers of diamond material in Garner are also formed on a carbide substrate as mentioned at column 2, lines 23-25, column 4, lines 30-32, column 4, lines 43-44, column 4, lines 53-54 and 56. Combining these two references would not suggest a DLC coating formed on the thrust shoulder of a steel alloy bearing pin. Liston teaches polycrystalline superlattice coatings for various bearing surfaces, but teaches away from DLC, as discussed at column 4, lines 1-17. Consequently, combining these three references, even if they are combinable, would not meet the claims as set forth.

In regard to claims 23 and 24, Nishiyama discloses a coating on a carbide substrate, not a steel alloy. Scott discloses forming a freestanding diamond film on a carbide substrate, then removing it from the carbide substrate and brazing it to the bearing pin. Liston discloses multiple layers of polycrystalline superlattice coatings for a bearing, not a DLC.

It is respectfully submitted that the claims are now in condition for allowance and favorable action is respectfully requested.

Respectfully submitted,

James E. Bradley

James E. Bradley
Reg. No. 27,536
Attorney for Applicants

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BRACEWELL & PATTERSON, L.L.P.
P. O. Box 61389
Houston, Texas 77208 1389
Tel.: (713) 221-3301
Fax: (713) 222-3287